NOTICE

All drawings located at the end of the document.

QUARTERLY REPORT

FOR OCTOBER THROUGH DECEMBER 1993

OPERABLE UNIT #1
IM/IRA TREATMENT FACILITY

PREPARED BY

ENVIRONMENTAL RESTORATION
FACILITIES OPERATIONS MANAGEMENT

EG&G ROCKY FLATS
GOLDEN, COLORADO

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1.0 INTRODUCTION

The Operable Unit No. 1 (OU-1) water treatment facility located in Building 891 is responsible for treating groundwater collected from the 881 Hillside area. The water is collected in a french drain located on the 881 hillside and pumped to the influent storage tanks located at Building 891 (see Figure 1). Next, the water is treated with an ultraviolet (UV) light/hydrogen peroxide system (for removal of volatile organic compounds) and a four-step ion exchange(IX) system (for removal of uranium, total dissolved solids (TDS), cations, anions, and selected metals). After treatment, the water is stored in one of three effluent storage tanks until laboratory sample results verify that the water is acceptable for discharge into the South Interceptor Ditch (SID).

2.0 INFLUENT WATER CHARACTERISTICS

Influent water for the treatment facility comes from three different sources on the 881 Hillside. These sources include the 881 footing drain, the recovery well CW001 (located upgradient of the french drain), and groundwater intercepted by the french drain. Water from the footing drain flows by gravity into the french drain, mixes with groundwater, and collectively flows by gravity towards the french drain sump. Recovery well water is pumped directly into the french drain sump and mixed with the groundwater/footing drain water. The combined water is then pumped from the french drain sump into the treatment system influent holding tanks. Sampling is performed at each of the three sources as well as at the influent to the UV system for characterization of the influent waters.

2.1 INFLUENT FLOW RATES

The recovery well pump operated for 15 minutes during the past quarter. It was estimated (using the pump curve) from this pumping time that approximately 75 gallons of water were pumped from the recovery well during this period.

The damage caused by a high volume flowrate event in the late summer of 1993 was repaired. Flowmeter operations appeared normal at the beginning of this quarter. It was noted, however, that over a two month's period, the flowmeter constantly required calibration. The pipe extension which was utilized for the weir installation had undergone minor deflections, resulting in variations of the probe readings. It was discovered that a .042" deflection caused the inaccurate readings. These minute variations in the depth sensed by the probe cause significant error in the flow measurements taken by the equipment; rendering data from October, November, and December inaccurate. These deflections were likely caused by periodic high flowrate events during periods of heavy precipitation. It is estimated that approximately 300,000 gallons of water entered the system from the 881 footing drain during the past

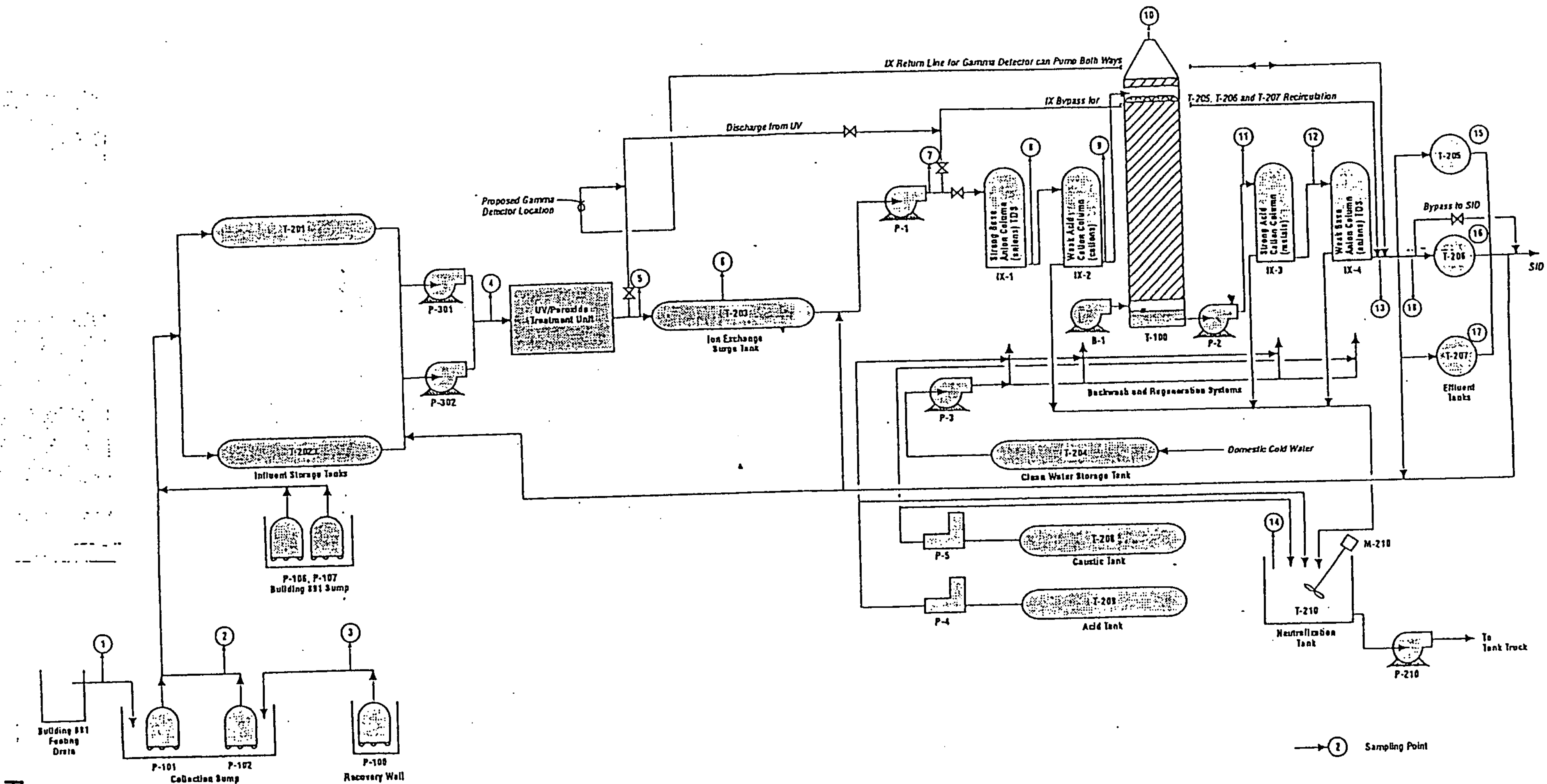


FIGURE 1
PROCESS FLOW DIAGRAM

quarter. However, these flowrates cannot be verified since the flowmeter will not currently hold calibration. A work package was issued to install a more rigid pipe extension to eliminate these deflections and maintain a constant depth reading. Installation is expected to take place in February.

Installation of magnetic flowmeters on the Building 891 influent and effluent lines is nearly complete. The data from these flowmeters will be compared to that of the 881 footing drain flowmeter for future mass balance calculations.

2.2 INFLUENT CONTAMINANTS

Results of samples taken at the hillside locations have not been received since the last quarterly report. Recent samples sent offsite for analysis have not been rushed in order to reduce analysis costs. Therefore, additional information is not available regarding the influent contaminants for this quarter.

Samples at remote locations (recovery well, french drain sump, footing drain) on the hillside were taken for both total and dissolved metals during the past quarter. Following this period, a transition to sampling for only dissolved metals will be initiated. This information will be more helpful in comparisons to ARARs.

3.0 FRENCH DRAIN MONITORING WELLS

The French Drain Performance Monitoring Plan (FDPMP) requires additional sample data for monitoring french drain performance. The FDPMP requires groundwater level measurements of designated french drain monitoring wells 10092, 10192, 10392, 10492, 10592, 10692, 10792, 10892, 10992, 11092, 39991, 45391, 4887, 35691, 31491, and 4787 (see Figure 2 for well locations). Additionally, quarterly sample analysis (see Section 3.2) of the wells is required.

3.1 WATER LEVELS

Weekly water level elevations for this quarter are shown in Figure 3. Water depth measurements are taken in relation to the top of the monitoring well casing. Results appear to be relatively consistent with last quarters readings.

WEEKLY MONITROING WELL WATER LEVELS

Well #	10092	10192	10292	10392	10492	10592	10692	10792	10892	10992	11092	31491	35691	45391	4787	4887
	Well elevations taken at the top of casing.															
	5900.5	5924.3	5925.5	5932.1	5932.8	5937.9	5943.6	5917.1	5929.2	5898.6	5895.3	5905	5941.4	5894.24	5884.6	5911.4
	Depth (ft.)/elevation to the bottom of well relative to top of casing.															
	23.08	21.08	26.28	29.07	34.4	28.19	23.44	26.26	26.28	33.67	23.06	23.66	30.46	23.49	9.8	12.37
	5877.4	5903.2	5899.2	5903	5898.4	5909.7	5920.2	5890.8	5902.9	5864.9	5872.3	5881.4	5910.9	5870.75	5874.8	5899
	Elevation at surface of water in well															
10/1/93	DRY	DRY	DRY	DRY	5902.3	5912	5936	5892.2	DRY	5866.1	5872.9	DRY	5922.3	5869.63		
10/8/93	DRY	DRY	DRY	DRY	5902.4	5912.5	5935.9	5892.6	DRY	5866.4	5873			5870.22	5875	5900.3
10/15/93	DRY	DRY	DRY	DRY	5902.4	5912.9	5935.9	5892.9	DRY	5866.7	5873.1			5870.65		
10/21/93					5902.3	5913.3	5935.7	5893.1		5866.9	5873.2			5870.83		
10/22/93	DRY	DRY	DRY	DRY					DRY							
10/29/93	DRY	DRY	DRY	DRY	5902.3	5911.3	5935.8	5892.1	DRY	5865.7	5872.7			5869.3		
11/1/93															DRY	
11/5/93	DRY	DRY	DRY	DRY	5902.3	5911.8	5935.8	5892.6	DRY	5866.2	5872.8			5869.96		
11/11/93					5902.5	5911.2	5936	5892.9		5866.5	5872.9			5870.78		
11/12/93	DRY	DRY	DRY	DRY					DRY							
11/19/93	DRY	DRY	DRY	DRY	5902.4	5911.2	5935.8	5891.7	DRY	5865.7	5872.7		5922.6	5869.64		
12/3/93	DRY	DRY	DRY	DRY	5902.4	5911.1	5935.8	5892.6	DRY	5866.5	5873			DRY	5875	
12/10/93	DRY	DRY	DRY	DRY	5902.4	5912.5	5935.9	5892.9	DRY	5866.8	5873.1			DRY		
12/16/93	DRY	DRY	DRY	DRY	5902.5	5912.7	5936.1	5893.1	DRY	5866.9	5873.2			5871.94		
12/21/93														5871.94		
12/22/93	DRY	DRY	DRY	DRY	5902.4	5911.1	5935.9	5892.1	DRY	5866	5872.9					
12/29/93	DRY	DRY	DRY	DRY	5902.4	5911.5	5935.8	5892.6	DRY	5866.3	5873			5869.83		

FIGURE 3

3.2 MONITORING WELL CONTAMINANTS

The following monitoring well parameters were identified at levels above ARAR for sampling from September through November (note that 10492, 10592, and 10692 are located beyond or near the western termination of the french drain).

WELL	DATE	PARAMETER	RESULT	ARAR
10492	9/23/93	Sulfate	320 mg/l	250 mg/l
	9/23/93	Total Dissolved Solids	1100 mg/l	400 mg/l
10592	9/23/93	Sulfate	350 mg/l	250 mg/l
	9/23/93	Total Dissolved Solids	1200 mg/l	400 mg/l
10692	9/23/93	Sulfate	340 mg/l	1300 mg/l
	9/23/93	Total Dissolved Solids	1300 mg/l	400 mg/l
	11/12/93	Sulfate	410 mg/l	250 mg/l
	11/12/93	Total Dissolved Solids	1300 mg/l	400 mg/l
10992	9/22/93	Nitrate/Nitrite	24 mg/l	10 mg/l
35691	9/15/93	Gross Alpha	35 pci/l	15 pci/l
	11/19/93	Sulfate	460 mg/l	250 mg/l
	11/19/93	Total Dissolved Solids	1400 mg/l	400 mg/l
45391	9/22/93	Total Dissolved Solids	460 mg/l	400 mg/l

The three wells located at or near the western termination of the french drain continue to demonstrate some parameters above ARAR. Volatile organic compounds (VOCs) that have ARARs were detected (Toluene $\approx$ 35 μg/l, Tetrachloroethene $\approx$ 1 μg/l, Trichloroethene $\approx$ .1 μg/l) at limits well below treatment requirements in several locations. The contamination found in these wells is being evaluated and will be presented in the OU1 Phase III Remedial Investigation Report.

4.0 800 AREA SURFACE WATER MONITORING STATIONS

Data not available at the time of draft quarterly report.

5.0 TREATMENT FACILITY PERFORMANCE

The treatment system performance is measured by various criteria. Quantity of water treated, contamination destruction or removal efficiency, waste generation, operating costs, chemical usage, and system reliability. Data on these criteria is utilized to modify or adjust the system as necessary for optimal performance. An operations database system is presently under development for computerized data entry of all operational information.

5.1 QUANTITY OF WATER TREATED

Approximately 210,000 gallons of groundwater were treated at the treatment facility during the past quarter. Approximately 220,000 gallons of treated effluent were released to the South Interceptor Ditch. Approximately 1,800,000 gallons of groundwater have been processed through the system to date.

5.2 WATER FROM OTHER SOURCES

An estimated 9,000 gallons of decontamination pad water was accepted at the treatment facility during the quarter. The decontamination pad water requires treatment at Building 891 due to low level volatile organics that cannot be processed through the 374 evaporator. This water currently remains stored in influent tank TK-201 until it can be processed through the treatment system.

5.3 CONTAMINATION DESTRUCTION/UV SYSTEM AND ION EXCHANGE SYSTEM EFFICIENCY SAMPLING

The primary purpose of sampling inside Building 891 is to determine the proficiency of the system for removing target contaminants. Ion exchange resins are periodically sampled to assist in evaluating the performance of the system. No resin samples were taken during the October through December period. However, information is available on the removal efficiency of the ion exchange columns. This information will be utilized to determine which column is the limiting factor in the ion exchange system. Modifications can then be made to extend the treatment capacity of the ion exchange system if possible.

5.3.1 ION EXCHANGE COLUMN #1

Ion Exchange column #1 contains a weak base anion exchange resin which serves to remove uranium from the groundwater. Influent water contains uranium in the form of a carbonate complex (negatively charged). This ion loads on the weak base resin located in the first ion exchange column, thus removing uranium from the water. Unlike the other resins in the system, this resin is not regenerated. A recent sample for total uranium 233, 234, 235, 238 showed removal efficiency of essentially 100%.

	INFLUENT	EFFLUENT
SAMPLE #	FT10059RG	FT10060RG
DATE	July 7, 1993	July 7, 1993
RESULT	7.71 ± 1.54 pci/l	0 ± .2 pci/l

5.3.2 ION EXCHANGE COLUMN #3

The ion exchange column #3 resin is termed as a strong acid cation exchanger. The primary function of this column is to remove hardness and metals from the water. Sample results obtained from the effluent of ion exchange columns #2 and #3 provide valuable information about the performance of this resin. The following presents data acquired from recent samples taken at these locations:

PARAMETER	SAMPLE	SAMPLE	% REMOVAL
	FT10123RG* 11/16/93 IX2 EFFLUENT pH=3.50	FT10124RG* 11/16/93 IX3 EFFLUENT pH=2.9	
Total Dissolved Solids	296 mg/l	64 mg/l	78%
Dissolved Calcium	17300 μg/l	149 μg/l (B)	99%
Dissolved Magnesium	15000 μg/l	28.6 μg/l (U)	99%
Dissolved Potassium	3160 μg/l	694 μg/l (B)	78%
Dissolved Sodium	51500 μg/l	5840 μg/l	89%
Dissolved Zinc	8.4 μg/l (B)	175 μg/l	- - -
Dissolved Strontium	131 μg/l	1.1 μg/l (B)	99%
Dissolved Lithium	13.4 μg/l	2.6 μg/l (U)	80%

* Samples taken after 34,000 gallons of water was treated through the column since the last regeneration of the resins. Presented results are preliminary, not validated. All CLP metals were analyzed, however most results were very close to detection limits and therefore were not useful in this analysis.

(B) Less than method detection limit but greater than or equal to instrument detection limit

(U) Parameter not detected at specified value

It is assumed that the IX#3 effluent zinc result is erroneous (since this cation would be expected to be exchanged) and should not be used in evaluating the zinc removal efficiency. When further data at these locations has been acquired , this assumption can be further evaluated as trends are established.

The pH of 2.9 on the effluent of column #3 would indicate that a significant amount of ion exchange is still taking place at this point and time. This is supported by the removal efficiency (about 90%) demonstrated in the above data.

5.3.3 ION EXCHANGE COLUMN #4

The ion exchange column #4 resin is a strong base anion exchange resin. The primary function of this resin is to remove anions (such as chloride, sulfate, nitrate/nitrite etc.) from the water. Data on the removal efficiency column #4 is obtained in a similar manner as described above. Samples are taken from the effluent of ion exchange columns #3 and #4 to observe the loading of anions on the resin bed. The following summarizes recent sample data:

PARAMETER	FT10124RG* 11/16/93 IX3 EFFLUENT pH=2.9	FT10125RG* 11/16/93 IX4 EFFLUENT pH=6.1
Chloride	102 mg/l	4.2 mg/l
Sulfate	45.7 mg/l	5.0 mg/l (U)
Total Dissolved Solids	64 mg/l	35 mg/l

- Samples taken after 34,000 gallons of water was treated through the column since the last regeneration of the resins. Results are preliminary, not validated.

(U) Parameter not detected at specified value

The manufacturer recommends regeneration of the resins at least every 56,500 gallons. In the above samples, it is evident that ion exchange is still taking place in both columns (#3 and #4). However, it is clear that at this point in 56,500 gallon cycle, the OH^- ion concentration contributed by IX#4 is no longer sufficient to counterbalance the H^+ concentration in the effluent from IX #2 and IX#3. A pH of 6-9 must be attained in the effluent tanks for discharge, and a regeneration of column #4 is necessary at this point.

5.4 CHEMICAL USAGE

Hydrochloric acid is utilized in the ion exchange system for regeneration of resins in column #2 (weak acid cation exchanger) and column #3 (strong acid cation exchanger). The resin in ion exchange column #4 (strong base anion exchanger) is regenerated with sodium hydroxide.

A total of 644 gallons of hydrochloric acid and 387 gallons of sodium hydroxide were used for regeneration and neutralization activities. Approximately 7 gallons of hydrogen peroxide were used for the UV/Peroxide destruction unit. Shipments of acid and caustic were received in December. The costs for the two shipments total approximately $2,200. Some problems were experienced with a shortage of hydrochloric acid supply related to the chlorine. Most vendors could not supply the amount of acid needed. It is unclear whether this problem may be experienced in the future.

5.5 WASTE GENERATION

Waste generated at the treatment facility includes sock filters and neutralized regenerant water. Less than one 55 gallon drum of sock filters has been generated in 21 months of operation. Eight tanker truck loads of neutralized regenerant water from Tank T-210 (31,000 gallons) were sent to the 374 evaporator for processing.

The eight listed "D" codes for the neutralized regenerant water were removed by EG&G Waste Technical Support.

5.6 OPERATING COSTS

Subcontracted operating costs for this quarter totaled approximately $48,000. These costs include chemical purchases, spare parts, labor, and document preparation.

5.7 MAINTENANCE

The following maintenance was performed during the October through December operating period:

* Relocation of valves on the ion exchange system was completed. This relocation was necessary in order to calibrate conductivity and pH probes in a timely fashion. Previously, it was necessary to drain ion exchange vessels to perform some calibrations.

* A backpressure valve was replaced on the acid regeneration skid.

* Brass tags were prepared for labeling of valves. Approximately 80% of the valves in the system are now properly labeled per plant standards.

* The leak detection system was restored to full operational status (the system had been partially damaged by a lightning strike).

* The gamma detection system computer was moved into the office area in preparation for future plans to monitor the gamma detection and gas chromatograph operations from the office.

* The phone jack for modem connection to the gas chromatograph computer was installed.

* The conductivity controller for ion exchange column #2 was replaced.

* The 881 footing drain solar panel was installed and achieved operability status.

* Additional support crossbracing was installed on the ion exchange system regeneration piping.

* An engineering work request was generated to develop a more stable installation mechanism for the 881 footing drain flowmeter. The design was completed and parts are due to be delivered in February for installation.

5.8 SYSTEM OPTIMIZATION

Based on the current information available, it appears as though the capacity of the Ion exchange system can be significantly increased by splitting the flows before ion exchange column #4. Further investigation will be performed on this matter. It is believed that this modification could increase the flow capacity between regenerations significantly. Reduction in chemical usage, liquid waste generation, and lost time due to regeneration activities would most likely occur.

6.0 ENVIRONMENTAL COMPLIANCE/EFFLUENT TANK SAMPLING

Each effluent tank is sampled and analyzed before discharge takes place. During the past quarter, two effluent tanks (TK-206 and TK-207) were discharged (approximately 220,000 gallons) into the south interceptor ditch. All parameters were below ARAR for these tanks.

7.0 REPORTS AND CORRESPONDENCE

The Scientific Notebook Plan was completed for system optimization activities at Operable Unit #1. This plan outlines the format to be utilized for documenting optimization work at the OU1 treatment facility.

Standard Operating Procedures have been prepared and are currently under review.

An initial Footing Drain Report was developed for discontinuation of collection of the footing drain. However, the report is not acceptable in its current form (reference DOE letter #ER:TLR:00161 dated January 19, 1994). Additional work will be needed in order to produce an improved report.

Letter from Waste Guidance removing listed "D" codes.

8.0 ANTICIPATED OPERATIONS FOR NEXT QUARTER

Normal operations will continue through March. It is expected that increased influent flowrates may be experienced at the end of March. Increased hours of operation may be necessary to keep pace with the spring flowrates.

The delivery of the gas chromatograph has been delayed due to optimization testing of the unit by the vendor. Some problems obtaining reproduceability have now been resolved.

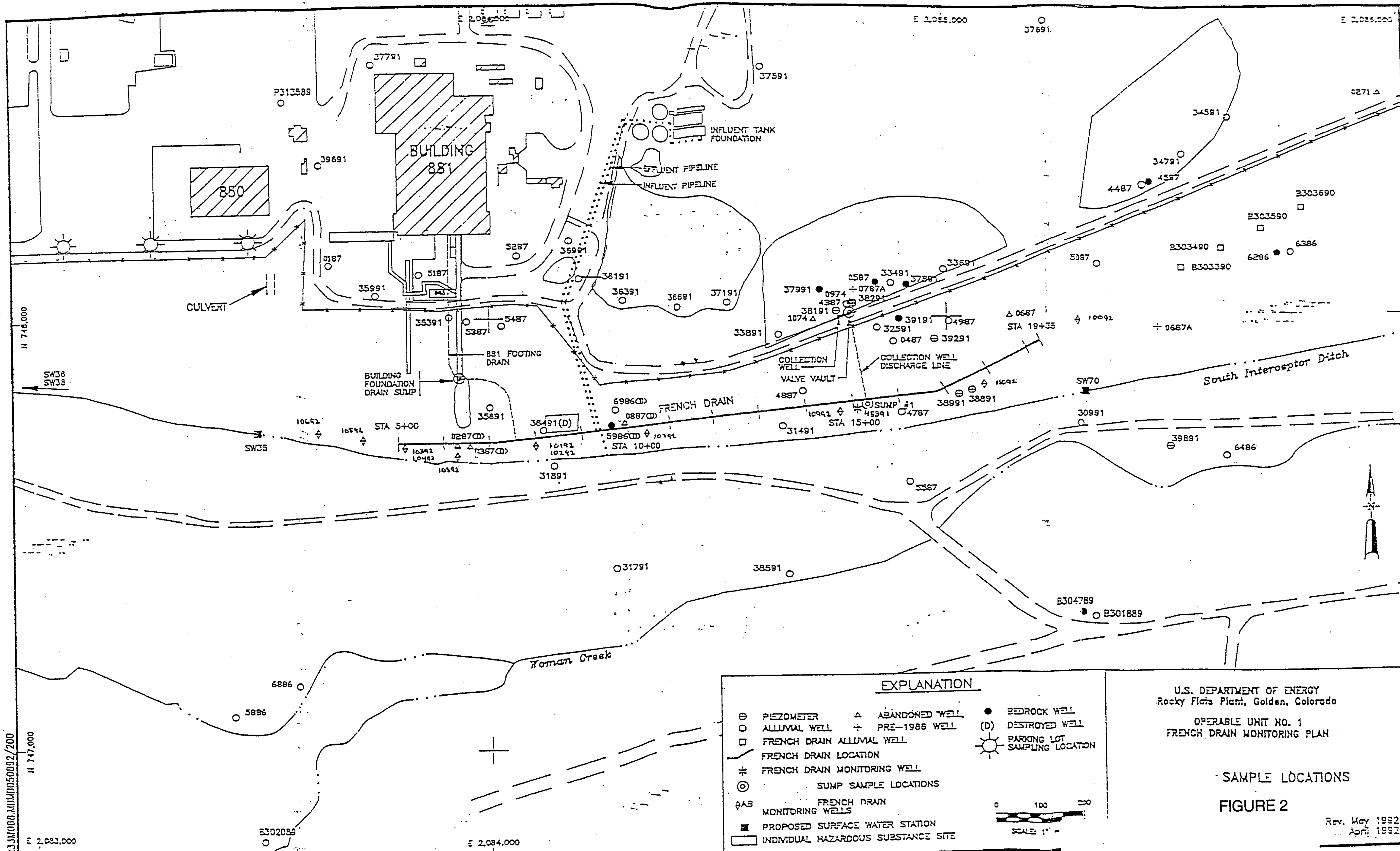
In addition, Environmental Operations Management is working with support organizations to resolve health and safety issues. It is expected that the unit will be installed by the end of February.

9.0 SUMMARY/CONCLUSIONS

The volume of water treated at the plant during the past quarter remained somewhat low. It is expected that increased flows will be experienced in late March. Approximately 1,800,000 gallons of water have been treated to date at the treatment facility.

Work on the report to discontinue collection of the footing drain water will continue. This report is considered one of the top priorities of the Environmental Operations Management personnel. All efforts are being made to proceed forward with this report in a timely fashion.

Further study will be performed on splitting flows around ion exchange column #4. Current information suggest that this modification would be a significant process improvement and could increase the treatment capacity of the ion exchange system between regenerations.



BUILDING 881
850
INFLUENT TANK FOUNDATION
EFFLUENT PIPELINE
INFLUENT PIPELINE
CULVERT
881 FOOTING DRAIN
BUILDING FOUNDATION DRAIN SUMP
FRENCH DRAIN
COLLECTION WELL
VALVE VAULT
COLLECTION WELL DISCHARGE LINE
SUMP #1
STA 5+00
STA 10+00
STA 15+00
STA 19+35
South Interceptor Ditch
Woman Creek
SW35
SW36
SW38
SW70
E 2,083,000
E 2,084,000
E 2,085,000
N 746,000
N 747,000
EXPLANATION
PIEZOMETER
ALLUVIAL WELL
FRENCH DRAIN ALLUVIAL WELL
FRENCH DRAIN LOCATION
FRENCH DRAIN MONITORING WELL
SUMP SAMPLE LOCATIONS
FRENCH DRAIN MONITORING WELLS
PROPOSED SURFACE WATER STATION
INDIVIDUAL HAZARDOUS SUBSTANCE SITE
ABANDONED WELL
PRE-1986 WELL
BEDROCK WELL
(D) DESTROYED WELL
PARKING LOT SAMPLING LOCATION
U.S. DEPARTMENT OF ENERGY
Rocky Flats Plant, Golden, Colorado
OPERABLE UNIT NO. 1
FRENCH DRAIN MONITORING PLAN
SAMPLE LOCATIONS
FIGURE 2
Rev. May 1992
April 1992